ORTEC
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INSTRUMENT
CENTER

MP MASTER
MA29080

Models 9301 and 9301S
Fast Preamplifiers
Operating and Service Manual

INSTRUMENT
CENTER

This manual applies to instruments
"Rev 01" on rear panel

Printed in U.S.A.

2581 N152Q 02C 0376

STANDARD WARRANTY FOR ORTEC INSTRUMENTS

ORTEC warrants that the items will be delivered free from defects in material or workmanship. ORTEC makes no other warranties, express or implied, and specifically **NO WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.**

ORTEC's exclusive liability is limited to repairing or replacing at ORTEC's option, items found by ORTEC to be defective in workmanship or materials within one year from the date of delivery. ORTEC's liability on any claim of any kind, including negligence, loss or damages arising out of, connected with, or from the performance or breach thereof, or from the manufacture, sale, delivery, resale, repair, or use of any item or services covered by this agreement or purchase order, shall in no case exceed the price allocable to the item or service furnished or any part thereof that gives rise to the claim. In the event ORTEC fails to manufacture or deliver items called for in this agreement or purchase order, ORTEC's exclusive liability and buyer's exclusive remedy shall be release of the buyer from the obligation to pay the purchase price. In no event shall ORTEC be liable for special or consequential damages.

QUALITY CONTROL

Before being approved for shipment, each ORTEC instrument must pass a stringent set of quality control tests designed to expose any flaws in materials or workmanship. Permanent records of these tests are maintained for use in warranty repair and as a source of statistical information for design improvements.

REPAIR SERVICE

If it becomes necessary to return this instrument for repair, it is essential that Customer Services be contacted in advance of its return so that a Return Authorization Number can be assigned to the unit. Also, ORTEC must be informed, either in writing or by telephone [(615) 482-4411], of the nature of the fault of the instrument being returned and of the model, serial, and revision ("Rev" on rear panel) numbers. Failure to do so may cause unnecessary delays in getting the unit repaired. The ORTEC standard procedure requires that instruments returned for repair pass the same quality control tests that are used for new-production instruments. Instruments that are returned should be packed so that they will withstand normal transit handling and must be shipped **PREPAID** via Air Parcel Post or United Parcel Service to the nearest ORTEC repair center. The address label and the package should include the Return Authorization Number assigned. Instruments being returned that are damaged in transit due to inadequate packing will be repaired at the sender's expense, and it will be the sender's responsibility to make claim with the shipper. Instruments not in warranty will be repaired at the standard charge unless they have been grossly misused or mishandled, in which case the user will be notified prior to the repair being done. A quotation will be sent with the notification.

DAMAGE IN TRANSIT

Shipments should be examined immediately upon receipt for evidence of external or concealed damage. The carrier making delivery should be notified immediately of any such damage, since the carrier is normally liable for damage in shipment. Packing materials, waybills, and other such documentation should be preserved in order to establish claims. After such notification to the carrier, please notify ORTEC of the circumstances so that assistance can be provided in making damage claims and in providing replacement equipment if necessary.

CONTENTS

Page

WARRANTY ii

PHOTOGRAPHS iv

1. DESCRIPTION 1

2. SPECIFICATIONS 1

2.1. Performance 1
2.2. Connectors 1
2.3. Electrical and Mechanical 1

3. INSTALLATION 2

3.1. Connection to Detector 2
3.2. Connection of Output 2
3.3. Input Power 2
3.4. Physical Location 2

4. OPERATING INSTRUCTIONS 2

5. CIRCUIT DESCRIPTION 3

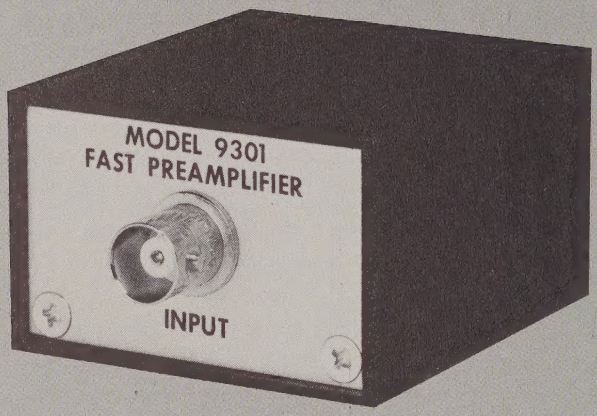
6. MAINTENANCE AND REPAIR 3

APPENDIX 4

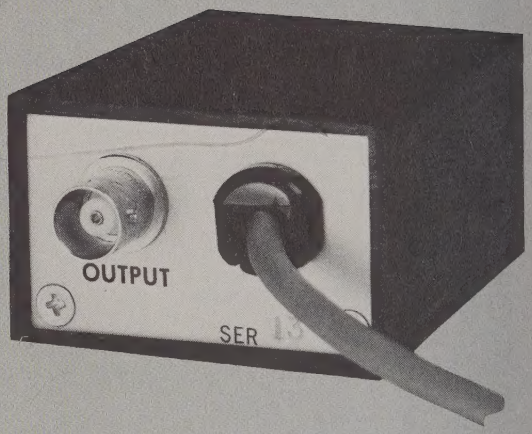
Replaceable Parts
Schematic 9301-0101-S1

ILLUSTRATION

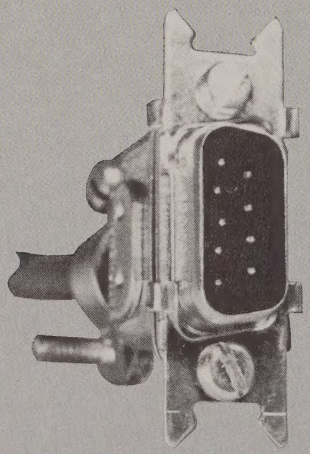
Fig. 5.1. Bottom View of DIN Power Input Connector 3



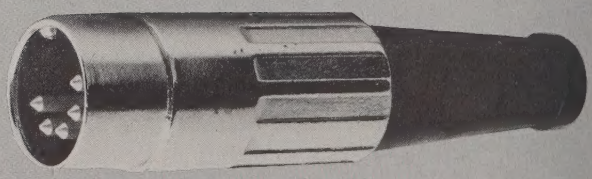
Front Panel



Rear Panel



9301



9301S

ORTEC 9301 and 9301S Fast Preamplifiers

1. DESCRIPTION

The ORTEC 9301 and 9301S Fast Preamplifiers are designed for use in fast timing system applications. They feature very low noise and fast risetime to facilitate precise timing measurements. Their small size and light weight permit them to be used in close proximity to the detectors they serve, and this minimizes noise in the output signals. The two Preamplifiers are identical except for the mating power connector at the remote end of the power cable. Although the reference in this manual is to the 9301, the instructions also relate to the 9301S.

The 9301 can be used with photomultipliers, electron multipliers, and other detectors that are employed in photon counting or ion counting techniques. When the preamplifier is connected to the detector, the 50Ω input impedance of the 9301 becomes the load resistance for the detector output current pulse.

The risetime of the 9301 output pulse is <1.5 nsec and the voltage gain is 10. This combination ensures the user that each input pulse from the detector will rise quickly through a normal discriminator threshold for a precise timing identification. The voltage gain of 10 also enhances the signal-to-noise ratio for the system.

Power for operation of the 9301 must be obtained from either the instrument to which its output pulses are furnished or from an ORTEC 114 Preamplifier Power Supply. A 10-ft power cable is built into the unit and terminated with an Amphenol 17-20090 plug. The Amphenol plug is compatible with the Preamp power source on a 114 Preamplifier Power Supply, a 9302 Amplifier/Discriminator, or any ORTEC NIM-standard amplifier module. For the 9301S the power cable is terminated with a DIN plug, compatible with the ORTEC Brookdeal 5C1 Photon Counting System.

2. SPECIFICATIONS

2.1. PERFORMANCE

Input Impedance 50Ω.

Voltage Gain 10 (±2%) noninverting.

Risetime <1.5 nsec.

Input RMS Noise Equivalent <25 μV.

Output Impedance 50Ω nominal.

Output Dynamic Range >±0.7 V into 50Ω.

Nonlinearity <1%.

Temperature Gain Instability <0.1%/°C.

2.2. CONNECTORS

Input Connector BNC, front panel.

Output Connector BNC, rear panel.

2.3. ELECTRICAL AND MECHANICAL

Power Required

+12 V, 30 mA;
−12 V, 30 mA.

Specify the 9301S for use with 5C1 Photon Counting System.

Specify the 9301 for connection to all other ORTEC equipment.

Dimensions 1.25 X 2 X 2.875 in. plus 10-ft cable.

3. INSTALLATION

3.1. CONNECTION TO DETECTOR

Connect an ac-coupled output from the detector to the Input BNC on the 9301 with coaxial cable. This cable should be kept as short as practical to minimize the physical distance through which the detector output current pulse has to pass. The amount of stray noise that will be added to the signal increases as the cable length increases. Use standard 50Ω coaxial cable.

An input pulse to the 9301 can be of either polarity; so it can originate from the anode or any dynode in, for example, a photomultiplier tube circuit. It must be ac-coupled to prevent high voltage from being applied across the 50Ω dc-coupled input circuit of the preamplifier. The output pulse from the 9301 will have the same polarity as the input and will be amplified by a factor of 10. The linear range of the output is +700 mV to −700 mV.

3.2. CONNECTION OF OUTPUT

The output impedance of the 9301 is nominally 50Ω. It is designed to drive any counter, amplifier, or timing instrument through a long length of 50Ω cable. The input impedance of the driven instrument is usually on the order of 1000Ω or more, and the series termination provided by the 9301 will usually be sufficient to prevent pulse reflections. If interference results from the basic interconnection, it can be reduced by an additional shunt termination of 50Ω at the input to the driven instrument, but this will also attenuate the signal amplitude by 50%.

Since the power cable for the 9301 is 10 ft long (standard), the separation of the preamplifier and the instrument being driven will usually be 10 ft maximum. Do not use signal cables that are excessive in length; the signal cable will normally be no longer than 10 ft.

3.3. INPUT POWER

Power for the 9301 is supplied through the captive 10-ft power cable. It can be furnished from any of a variety of sources, such as the ORTEC instrument to which the output pulses are being furnished or an ORTEC 114 Preamplifier Power Supply. The power requirements are +12 V, 30 mA, and −12 V, 30 mA, and can be furnished from a center-tapped 24-V battery if desired.

The 9301 Fast Preamplifier includes an Amphenol 17-20090 plug, at the remote end of the power cable, which is wired to accept +12 V through pin 4, −12 V through pin 9, and ground through pins 1 and 2. It is directly compatible with any ORTEC NIM-standard module that has a Preamp power connector mounted on the rear panel, or an ORTEC 114 Preamplifier Power Supply, a 9302 Amplifier/Discriminator, or a 9305 Photometer.

The 9301S Fast Preamplifier includes a DIN plug at the remote end of the power cable. This plug is compatible with the preamplifier power source that is included in the ORTEC Brookdeal 5C1 Counting System.

Power cable lengths other than the standard 10 ft are available on special order, with either an Amphenol 17-20090 or a DIN plug used for termination.

3.4. PHYSICAL LOCATION

The 9301 weighs only 6 oz and can normally be supported by its cables. There are no mounting facilities required for the unit, and it will usually be located in close proximity to the source of input pulses to minimize stray noise pickup.

4. OPERATING INSTRUCTIONS

There are no operating controls or adjustments for the 9301 Fast Preamplifier. Simply connect its power and input and output signals as described in Section 3 and its operation will be automatic.

If desired, a pulse generator can be substituted for the source of input pulses to check system response. The input pulse amplitude to the 9301 should not exceed 70 mV of either polarity.

5. CIRCUIT DESCRIPTION

The circuit of the 9301 Fast Preamplifier is shown in schematic 9301-0101-S1 at the back of the manual. Basically it is a noninverting operational amplifier with a gain of 10 from the input to the output. The output is buffered through emitter-follower Q3 and furnished through C8 to the Output connector, CN2. Figure 5.1 shows the connections that use a DIN connector rather than an Amphenol 17-20090 for the power input.

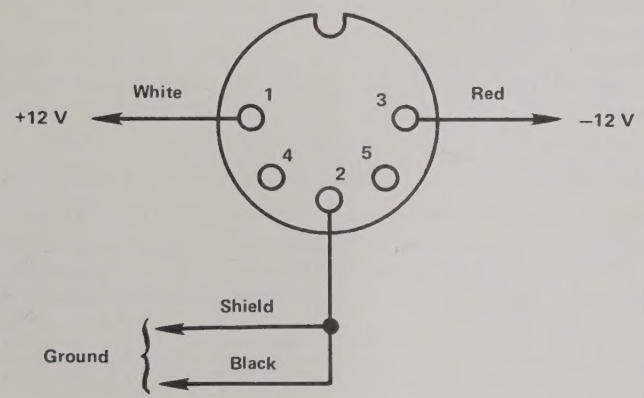


Fig. 5.1. Bottom View of DIN Power Input Connector.

6. MAINTENANCE AND REPAIR

Keep the signal and power connectors clean and free from any accumulation of dust. No other maintenance should be required. If the preamplifier is suspected of malfunction, check to see that the required dc power levels are being furnished and then use a pulse generator to check its response to input signals as suggested in Section 4.

APPENDIX

REPLACEABLE PARTS

ORDERING INFORMATION

The Replaceable Parts List shown below contains information needed for ordering spare and/or replacement parts. Each listing indicates the reference designator number, the part number, a description of the component, and the part manufacturer and manufacturer's part number.

All inquiries concerning spare and/or replacement parts and all orders for same should include the model serial, and revision ("Rev" on rear panel) numbers of the instruments involved and should be addressed to the Customer Service Department at 100 Midland Road, Oak Ridge, Tennessee 37830. The Manager of Customer Services can be reached by telephone at (615) 482-4411. The minimum order for spare and/or replacement parts is $25.00.

ORDERING INFORMATION FOR PARTS NOT LISTED

In order to facilitate the ordering of a part not listed below, the following information should be submitted to the Customer Service Department:

1. the instrument model number,
2. the instrument serial number,
3. revision ("Rev" on rear panel) number,
4. a description of the part,
5. information as to the function and location of the part.

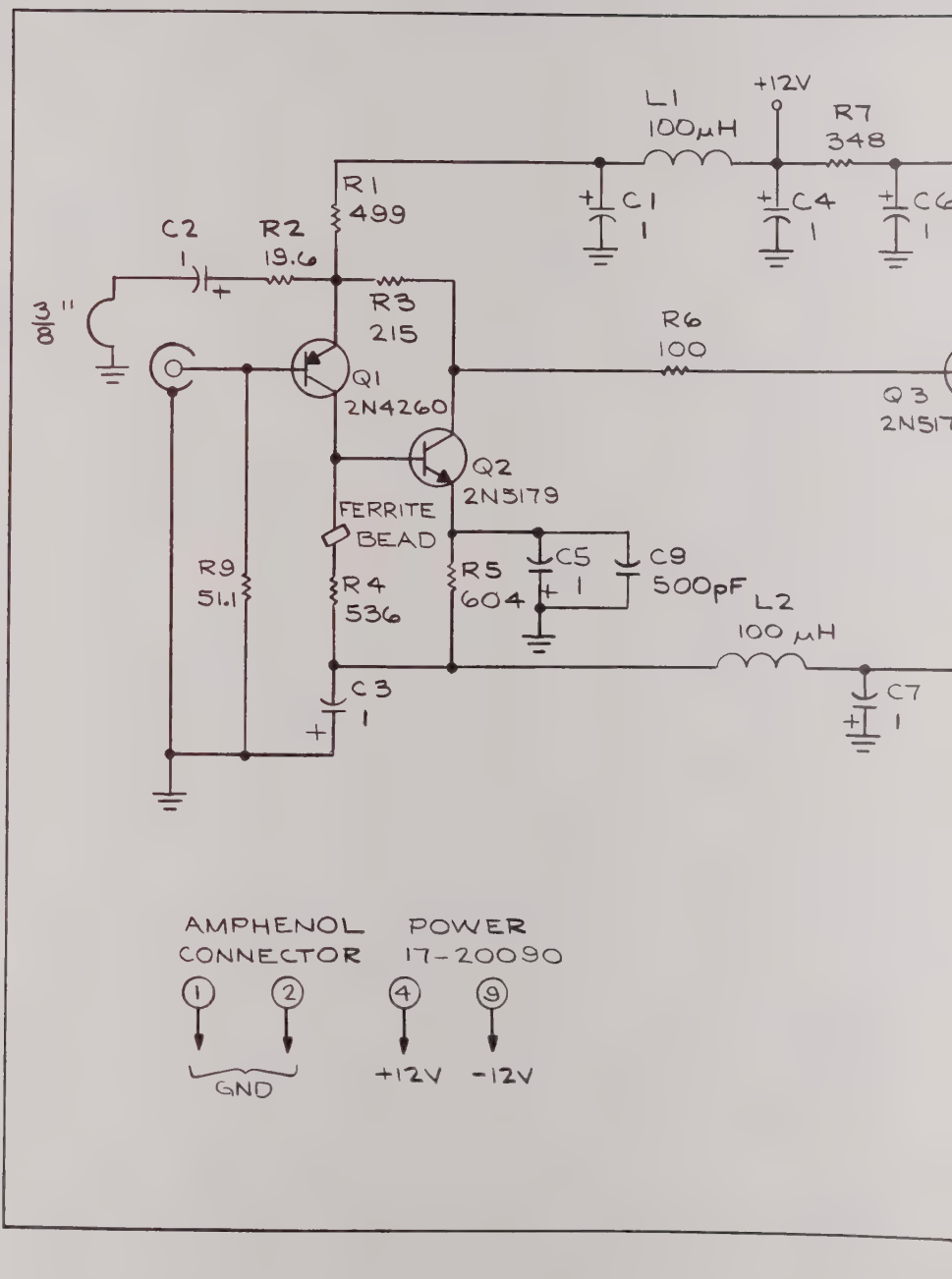
The solid-state-device (diodes, transistors, and integrated circuits) types installed in your instrument may differ from those shown in the schematic diagram and parts list. In such cases, necessary replacements can be made with either the type shown or the type actually installed in the instrument.

Replaceable Parts List

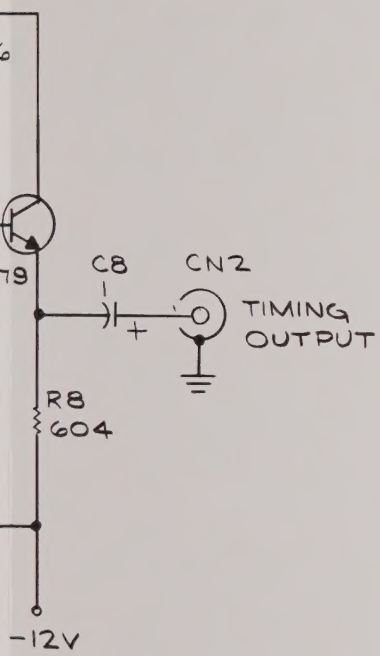
REFERENCE DESIGNATOR	ORTEC PART NO	DESCRIPTION	MFR	MFR PART NO
9301-0100	5004 46214			
8	9097 41339	Connector, BNC	95712	DGE #UG1094/U
9301-0200	5007 46215			
C1	9065 40942	1 uf 20% 35V Tan.	80183	SPR #150D105X0035A2
C2	9065 40942	1 uf 20% 35V Tan.	80183	SPR #150D105X0035A2
C3	9065 40942	1 uf 20% 35V Tan.	80183	SPR #150D105X0035A2
C4	9065 40942	1 uf 20% 35V Tan.	80183	SPR #150D105X0035A2
C5	9065 40942	1 uf 20% 35V Tan.	80183	SPR #150D105X0035A2
C6	9065 40942	1 uf 20% 35V Tan.	80183	SPR #150D105X0035A2
C7	9065 40942	1 uf 20% 35V Tan.	80183	SPR #150D105X0035A2
C8	9065 40942	1 uf 20% 35V Tan.	80183	SPR #150D105X0035A2
C9	9059 40893	500 pf 5% 500V D.M.	84171	ARC #DM15-501G
L1	9092 41246	Weeductor - 100 µh, 5%	72259	NTC
L2	9092 41246	Weeductor - 100 µH, 5%	72259	NTC
Q1	9078 43644	Transistor - 2N4260	80211	MOT
Q2	9078 43659	Transistor - 2N5179	80211	MOT
Q3	9078 43659	Transistor - 2N5179	80211	MOT

Replaceable Parts List (continued)

REFERENCE DESIGNATOR	ORTEC PART NO	DESCRIPTION	MFR	MFR PART NO
9301-0200 Cont'd.	5007 46215			
R1	9027 43698	499 Ω 1/8W 1% MF	24546	CGW C-4
R2	9027 40588	19.6 Ω 1/8W 1% MF	24546	CGW C-4
R3	9027 40497	215 Ω 1/8W 1% MF	24546	CGW C-4
R4	9027 40554	536 1/8W 1% MF	24546	CGW C-4
R5	9027 40568	604 Ω 1/8W 1% MF	24546	CGW C-4
R6	9027 40489	100 Ω 1/8W 1% MF	24546	CGW C-4
R7	9027 40504	348 Ω 1/8W 1% MF	24546	CGW C-4
R8	9027 40568	604 Ω 1/8W 1% MF	24546	CGW C-4
R9	9027 40484	51.1 Ω 1/8W 1% MF	24546	CGW C-4
9301-C1	6011 46231			
1	9148 44542	Cable, 3-Cond. Shielded	70903	BMC #8771 (22 ga.)
2	9097 41310	Connector, Power, 9-Pin	02660	ABE #17-20090
3	9097 41354	Cable Housing	02660	ABE #17-31001
4	9097 41307	Latch, End. Disc.	02660	ABE #17-542-02
5	9149 41913	Shrinkable Tubing, 3/16"	AWC	AWC #FIT-221-3/16


L1
100μH
+12V
R7
348
R1
499
C1
1
C4
1
C2
1
R2
19.6
R3
215
R6
100
Q1
2N4260
Q2
2N5179
FERRITE
BEAD
R9
51.1
R4
536
R5
604
C5
1
C9
500pF
L2
100 μH
C7
1
C3
1
AMPHENOL
CONNECTOR
POWER
17-20090
1
2
4
9
GND
+12V
-12V

NOTES: UNLESS OTHERWISE SPECIFIED
1. RESISTOR VALUES IN OHMS
2. CAPACITOR VALUES IN μF
3. ALL RESISTORS ARE 1/8 WATT, 1% METAL FILM



UNLESS OTHERWISE SPECIFIED
DIMENSIONS IN INCHES
TOLERANCES

FRACTIONS	DECIMALS	ANGLES	FINISH
± 1/64	.XX ± .01 .XXX ± .005	± 0°30'	√ RMS

MATERIAL

APPLIED PRACTICES

REVISIONS | ECN NO. | DATE | BY | REV.

ORTEC INCORPORATED — AN EG&G COMPANY

100 MIDLAND ROAD, OAK RIDGE, TENNESSEE 37830

TITLE: MODEL 9301 FAST PREAMP

DRAFTSMAN: CSJ — DATE: 3-23-72	RESPONSIBLE ENGINEER: H TAYLOR		REFERENCE/USED ON
CHECKED: WCC — DATE: 3-27-72	ENG. APPROVAL: H Taylor — DATE: 3/29/72		STOCK NO.
SCALE: NONE	MFG. APPROVAL: B Denning — DATE: 6-28-73		DRAWING NO. 9301-0101-S1
DWG. ISSUED: — DATE: 7-2-73	RELEASED FOR MFG. — DATE		

76 Offices in 49 Countries.

For more information on ORTEC products or their applications, contact your local ORTEC Representative or:

United States:
ORTEC Incorporated, 100 Midland Rd., Oak Ridge, TN 37830, telephone (615) 482-4411, Telex 55-7450

W. Germany:
ORTEC GmbH, Munich, telephone (089) 98-71-73

United Kingdom:
ORTEC Limited, Luton, Bedfordshire, telephone (0582) 27557

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